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GAS ABSTRACTS

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Contents

1. Gas Industry 120
2. Appliances 122
3. Combustion and Industrial Furnaces..... 122
4. Carbonization and Gasification..... 122
5. Natural Gas and Natural Gas Condensates..... 125
6. Petroleum and Synthetic Liquid Fuels..... 127
7. Analytical Methods and Tests..... 130
8. General and Physical Chemistry..... 133
10. Chemical Engineering 135
11. Process Equipment and Instrumentation..... 137
12. Materials of Construction..... 138

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1. GAS INDUSTRY

Fire Protection

Maloney, M. MAINTENANCE OF INDUSTRIAL FIRE FIGHTING EQUIPMENT. *Southern Power and Ind.* **66**, 84-86, 152, 154 (1948) *May.*

Two fire safety policies are essential to industry: (1) fire prevention, and (2) fire protection. Many methods are described under fire prevention. Emphasis is placed on the action taken during the first few minutes after fire strikes. A complete list of fire fighting equipment is given and the maintenance of this equipment is fully explained. Finally, it is most important to show all employees how to operate the equipment.

E. M. Rueck

Gas Service Construction Mechanization

Currens, J. E. C. MECHANIZATION OF GAS SERVICE CONSTRUCTION. Paper presented at the 1948 Distribution, Motor Vehicle and Corrosion Conference at Pittsburgh, Pa., April 19-21, 1948.

The Pacific Gas and Electric Company has recently undertaken mechanization of gas service construction principally because of an increase in the number of customers due to a tremendous immigration into California. In 1947, 6.5 million feet of distribution mains were laid. The present cost of installing service to a customer is about $70.00 per service, but the author believes that with proper planning and mechanization that the cost could be reduced to $13.50 per service. The features desired in a trenching machine are discussed.

W. J. Merwin

Natural Gas Act

Dougherty, W. A. SIGNIFICANCE OF TEN YEARS UNDER THE NATURAL GAS ACT. *Am. Gas Assoc. Monthly* **30**, 16-18, 48-49 (1948) *June.*

This resume of the high points of F.P.C. regulation under the Natural Gas Act during the last decade sums up the reasons why the gas industry feels that amendments to the Act are needed. Proposed amendments now pending Congressional action are discussed and their significance is explained.

J. C. Lane

Natural Gas Expansion

THE SPREAD OF GAS. *Gas* **24**, 38-39 (1948) *May.*

According to a recently conducted survey, 95 major gas companies will spend some $290 million to increase the flow of gas to their customers by nearly one billion cu ft. Expenditures for expansion would be much larger, probably in the billion dollar range, if it were not for equipment shortage and the delays caused by the necessity for governmental certification. The article lists a number of the major projects by company, estimated cost, purpose of outlay, increased sendout, and other descriptive details.

J. C. Lane

Petroleum Industry

Adams, E. $4 BILLION MARKED FOR 1948 EXPANSION. *Petroleum Engr.* **19**, 63-71 (1948) *May.*

The 1947 annual reports of 48 petroleum companies have been studied to obtain a picture of the state of the industry and the trend which it

may be expected to follow during 1948. Excerpts from the reports of individual companies are utilized to illustrate some of the problems currently facing the industry. Capital expenditures for expansion totaled about $3 billion in 1947, but probably would have reached $4 billion if it had not been for material shortages.

J. C. Lane

Projected Natural Gas Processing Units

Mirrors, I. P. E. PROJECTED NATURAL-GAS PROCESSING UNITS RATED AT BILLION-FOOT DAILY CAPACITY. *Oil Gas J.* 47, 181, 183 (1948) *May* 20.

Natural-gasoline and cycling-plant construction planned, authorized, or building is listed by company, location, type of project, capacity rating, and expected date of completion. The 19 natural-gasoline plants under construction have a total rated input-gas capacity of more than one billion cu ft per day. The capacity-rating total of the eight authorized natural-gasoline projects is nearly 600 million cu ft per day of gas input. No ratings are reported for the four natural-gasoline plants in the planning stage, but an estimate of their probable total capacity shows a gas input of nearly half a billion cu ft per day.

J. C. Lane

Synthetic Fuels

Brown, B. K. and Gunness, R. C. FUTURE FUELS—LIQUID AND GASEOUS. *Mech. Eng.* 70, 421-424 (1948) *May.*

Coal's share of the nation's total energy production declined from 80% in 1920 to 48% in 1947, while that of oil and natural gas increased from 16% to 48% over the same period. Attractive prices, as well as cleanliness and convenience, are responsible for this shift. Both petroleum and natural gas have undergone a quadrupled increase in consumption during the last 25 years. Estimates of the domestic demand for petroleum products in 1970 indicate an over-all increase of 31% over 1947. The supply of residual fuel oil available in 1970 is expected to be almost 10% less than it was in 1947 because more of it will be converted to gasoline and distillate fuels. Other fuels, particularly coal, will have to assume an increasing portion of the nation's industrial-fuels load. An analysis of the known methods for producing synthetic liquid fuels indicates that the Fischer-Tropsch process utilizing natural gas as the raw material is the most economical scheme but would, nevertheless, involve a multi-billion dollar plant investment. Similar synthesis from coal would be considerably more expensive and would require doubling of the nation's 1941 production of bituminous coal to satisfy even the 1947 demand for petroleum products. Shale and tar sands seem less attractive possibilities because of the mining and handling required. However, gas reserves are too limited to permit extremely heavy reliance on them for oil synthesis. For normal heating purposes, there is no economic justification for converting gas to distillate fuel oil, although diversion of substantial quantities of natural gas to the synthesis of gasoline, premium Diesel fuel, and organic chemicals seems likely as a long-range project. The trend toward higher quality gasolines and Diesel fuels in automotive equipment is discussed and the probability that gas turbine and jet engine developments will cause a change in aviation requirements is considered.

J. C. Lane

Steel Requirements

TOTAL GAS INDUSTRY STEEL REQUIREMENTS EXCEED 4,000,000 TONS. *Gas Age* 101, 27, 58, 60 (1948) *May* 13.

The gas industry's estimated steel requirements

for the 18-month period starting April 1, 1948, are broken down by types.

J. C. Lane

The following article, which has not been abstracted, is called to your attention:

1947 SPENDING FOR EXPANSION SETS RECORD, OIL COMPANY REPORTS SHOW. *Natl. Petroleum News* **40**, 40-41 (1948) *June* 2.

2. APPLIANCES

Radiant Heating

Adlam, T. N. SOME PROBLEMS I'VE MET IN RADIANT HEATING. *Heating, Piping, Air Conditioning* **20**, 84-89 (1948) *June.*

Radiant heating systems, not properly engineered, can cause excessive drafts and overheated floors. By proper location and spacing of the pipes in the floors and ceilings these problems can be overcome. The author also recommends careful consideration of the floor covering before designing a floor heating panel. Other design problems are discussed.

E. F. Davis

3. COMBUSTION AND INDUSTRIAL FURNACES

Gas Cyaniding

Ipsen, H. N. GAS CYANIDING SMALL PARTS. *Iron Age* **161**, 84-87 (1948) *May.*

A detailed description of a gas cyaniding furnace for hardening small metal parts is given. Unique features of the furnace are automatic heating and quenching and ejection of the hardened piece. The operating cost is about 6 mils/lb steel.

E. F. Davis

4. CARBONIZATION AND GASIFICATION

Coke Oven Plants

Wardner, W. C. INCREASING GAS PRODUCTION FROM COKE OVEN PLANTS. Paper presented at the 1948 Joint Production and Chemical Committee Conference at Asbury Park, New Jersey, May 24-26, 1948.

A survey of operating plants has indicated the following present-day practices in meeting increased gas demands: (1) increasing coal through-put in coke ovens by decreasing the coking time; (2) shutting down light oil plants except for the naphthalene scrubbers, thus allowing light gasolines to pass with the normal sendout; (3) carbonizing coal premixed with oil, particularly Bunker "C" in a concentration up to 5 gal/ton; (4) gasifying oil in unserviceable coke ovens; (5) using oil with coal to maintain a uniform maximum bulk density in coking operation; (6) underfiring coke ovens with gas substitutes, thus releasing for send out the coke oven gas used in normal firing; (7) increasing oven gas sendout by admixing with natural and producer gas; (8) varying the water gas operation; (9) cold enriching with LP gases; and (10) carbonizing cannel coal

mixtures in coke ovens. A table indicating the number of plants using the above procedures is included. It is noted that bulk density control is most widely employed.

C. Von Fredersdorff

Distribution

Bittner, V. F. METHOD OF DETERMINING PUMPING PRESSURES BY UTILIZING SQUARE MILE ESTIMATES. Paper presented at the 1948 Distribution, Motor Vehicle and Corrosion Conference at Pittsburgh, Pa., April 19-21, 1948.

Pressure drop calculations were made for the Chicago area using 1 sq mile area units for a proposed peak load of 500,000 Mcf/day. It was decided that the inner or city territory should be operated as an open system while the outer districts should be operated separately.

J. D. Parent

Distribution

Cooper, G. A. S. ECONOMIC FACTORS FOR DISTRIBUTION DESIGN. Paper presented at the 1948 Distribution, Motor Vehicle and Corrosion Conference at Pittsburgh, Pa., April 19-21, 1948.

An effort is made to show all costs for a distribution system so as to permit most economical design. An illustration is provided.

J. D. Parent

High BTU Gas Manufacture

Stephens, J. P. EQUIPMENT AND PROCESSES FOR MANUFACTURING HIGHER BTU GASES. Paper presented at the 1948 Joint Production and Chemical Committee Conference, Asbury Park, N. J., May 24-26, 1948.

The usual equipment available for the production of high Btu gases consists of standard water gas sets modified by the addition of necessary equipment to increase oil input. These modifications consist usually of the addition of oil sprays and steam nozzles in the generator dome and sometimes require additional main connections. Of particular interest is the Hall oil gas process in which the equipment consists of two parallel generators and superheaters undergoing alternate blast and make periods.

C. Von Fredersdorff

Oxide Purification

Hopton, G. U. REMOVAL OF HYDROGEN SULPHIDE FROM COAL GAS. *Gas World* (*British*) **128**, 538-544 (1948) *April* 10.

The author combines a review of current plant practice and experimental results reported in the literature with the findings of his own research on the development of special forms of iron oxide for H_2S removal from coal gas. He discusses the reactions of H_2S with the various common forms of iron oxide and points out that, of the seven known forms of iron oxide, alpha-$Fe_2O_3 \cdot H_2O$ formed by atmospheric oxidation of ferrous hydroxide or carbonate is most active. This type of iron oxide in bog ore is excellent, but other natural forms of this same oxide such as goethite, yellow ochre, and weathered ironstone are inactive due to a lack of porosity caused by their high densities. The improvement of poorer grades of oxide with use is explained by the fact that all oxides react with H_2S to yield $Fe_2S_3 \cdot H_2O$ which can be oxidized to the desired alpha-$Fe_2O_3 \cdot H_2O$ with air if neutral or slightly alkaline condition and moderate temperatures are maintained. The upgrading of poorer oxides by the method of rotation, while possible, is generally considered too difficult to be of economic value. Preliminary data

on tests made with the author's specially prepared oxides shaped as nodules and as tablets are presented, and types of purifier containers, costs, effect of the direction of gas flow through oxide beds, plant cleanliness, moisture, and temperature are discussed. It is stated that 90°F. is the ideal purifier temperature. Lower temperatures lead to condensation difficulties and higher temperatures reduce the life of the oxide. Observations on the caking of oxide during use indicate that temperature is one of the most important factors in this complex problem.

H. Hakewill

Oxide Purification

Hopton, G. U. THE REMOVAL OF HYDROGEN SULPHIDE FROM COAL GAS BY MEANS OF IRON OXIDE. *Gas J.* (*British*) 254, 100-102, 105-106, 111 (1948) *April* 14.

The causes for variations in the reactivity of various iron oxides with H_2S were investigated. Some of the factors found to be of importance were: (1) previous heat treatment, (2) pH, (3) packing density, (4) temperature, and (5) porosity of particles. The materials ordinarily employed in purifiers are discussed, and a recent development in the preparation of highly active pelleted material for use in special purifiers is described. The latter procedure is proposed for peak load purification where its relatively high cost is partially offset by the simplicity of the plant required. Two tests with inlet gases containing 5 grains H_2S per 100 cu ft demonstrated the advantages of the pelleted iron oxides. Methods for evaluating purification materials are reviewed and the activity test recommended by Griffith and Hopton was used to compare a number of oxide forms. Information and data on the design of purifiers is included.

H. Hakewill

Hopton, G. U. THE REMOVAL OF HYDROGEN SULPHIDE FROM COAL GAS BY MEANS OF IRON OXIDE. *Gas J.* (*British*) 254, 158-160, 163, 164, 169 (1948) *April* 21.

This article is a continuation of an earlier paper on the subject of oxide purification. The merits of sunken, ground level, two-tier, and three-tier systems for oxide boxes are pointed out. The direction of gas flow through boxes, temperature of operation, installation and operation costs are considered. Optimum conditions for the operation and control of purifiers are discussed. Procedures for using burnt oxide are described. The techniques and precautions to follow when adding air to purification systems are outlined and average gas temperatures and moisture changes in the boxes are tabulated. The frequency of rotating oxide boxes, maintenance of cleanliness, and leakage through valves are also taken up. Oxide caking appeared to be independent of sulfur deposits in the boxes, while moisture and temperature changes seemed important. It is recommended that finely divided oxides or those containing much clay should be avoided and that shavings or peat be employed to reduce caking.

H. Hakewill

Town Gas Manufacture

Dent, F. J. USE OF OXYGEN FOR TOWN GAS MANUFACTURE. *Gas Times* (*British*) 54, 217-218, 220-222 (1948) *February* 13.

Recent proposals based mainly on the Lurgi principle of pressure gasification have received considerable attention. The usual advantages cited for oxygen gasification are greater thermal efficiency, higher heating value of the make gas, and simplifications in purification and distribution. A comparison with existing methods of gasification in England (carbonization and water gas operation) seems to indicate that a gas comparable in cost to present manufactured gases could be obtained by high pressure gasification. It is further believed that (1) high pressure gasification would not immediately lead to a gas supply of substantially lower price since considerable development of both process

and utilization is necessary and (2) cost of oxygen is unlikely to effect the development of oxygen gasification processes.

C. Von Fredersdorff

Vertical Retort Gas-Making Plants

Dixon, A. W. THE DESIGN AND OPERATION OF VERTICAL RETORT GAS-MAKING PLANTS FOR SMALL WORKS—I. *Gas Times* (*British*) **55**, 32-34 (1948) *April* 9.

In English gas works having a declared heating value of the gas below 500 Btu per cu ft, economic production of gas and coke is accomplished principally by vertical retort carbonizing plants with the basic aim of standardization and increased retort capacity rather than of drastic alteration in plant construction. The small undertaking has usually been financially embarrassed as regards initial cost of modern equipment, and in cases where such equipment was obtained, operation proved to be very inefficient due principally to uneconomical design. For the benefit of the small concerns, consideration is given to (1) reduction of capital investment, (2) design of extractor and gear to permit either continuous or intermittent vertical retort operation, (3) design of a retort door with seal, (4) method of accomplishing dust-free discharge of quenched coke, and (5) design of heating system, control of plant and elimination of chimney.

C. Von Fredersdorff

Dixon, A. W. THE DESIGN AND OPERATION OF VERTICAL RETORT GAS-MAKING PLANTS FOR SMALL WORKS—2. *Gas Times* **55**, 90, 92-93 (1948) *April* 23.

The simple sliding door type of extractor used in intermittent systems of retort operation was found to be advantageous over those in the continuous system of operation. The problem of gas leakage past the hinges of retort doors was overcome by the development of a door with a "positive" seal, the essential feature of which is a means of introducing steam between an inner- and outer-door combination. Further consideration is given to dust free discharge of quenched coke and a simplified means of heating and plant control.

C. Von Fredersdorff

5. NATURAL GAS AND NATURAL GAS CONDENSATES

Booster Station

Mueller, A. V. COOLING WATER REQUIREMENTS FOR NATURAL GAS BOOSTER STATIONS. *Pipe Line News* **16**-18 (1948) *June*. See *Gas Abstracts* **4**, 29 (1948) *February* for abstract.

Bottom Hole Pressure Gage

Hawkins, M. F. METHOD OF LEAST SQUARES APPLIED TO BOTTOM HOLE PRESSURE GAGE CALIBRATION. *Petroleum Engr.* **19**, 93-94 (1948) *April*.

Several errors attendant in plotting the data obtained from calibration of bottom hole pressure gages may be eliminated by handling the data mathematically. The Method of Least Squares is a statistical method that weighs the points properly, giving more weight to larger values that are of greater influence in correctly

determining the slope and intercept of the line. The method is demonstrated by an application to the handling of the calibration data of a bottom hole pressure gage.

W. K. Zahray

Centrifugal Compressors

Goodrick, B. D. CENTRIFUGAL COMPRESSORS COME OF AGE. *Am. Gas Assoc. Monthly* **30**, 12-15, 50-51 (1948) *June.*

The Texas Eastern Transmission Corporation was the first natural gas transmission company to use centrifugal compressors in addition to conventional reciprocating units to transmit large volumes of natural gas under high pressures over long distances. In this article, the chief engineer of this company discusses their experience of less than a year's duration with the centrifugal compressors on this pipe line. Construction details, operating characteristics and advantages of these compressors are given. The author believes that the centrifugal compressor has a very definite place in the long distance transmission of natural gas.

J. H. Kelly

Comparison of 2-Cycle and 4-Cycle Engines

COMPARISON AND RATING OF TWO CYCLE AND FOUR CYCLE SPARK IGNITION. *World Oil* **127**, 154 (1948) *April.*

Some general information is given. The terms two-cycle and four-cycle are defined and the following statements are made: (1) two-cycle engines develop 70% more power than four cycle engines at the same speed; (2) two-cycle engines can be run at about 80% capacity; (3) four-cycle engines should not be run at more than 70% capacity; (4) piston speed should not exceed 1,000 fpm; (5) power loss due to altitude is about 3% per 1000 ft rise in elevation.

J. D. Parent

Abstractor's Note: One of the formulae for power is incorrect.

Compressor Building

Pryor, C. C. COMPRESSOR BUILDING FOR GASOLINE PLANT. *Petroleum Refiner* **27**, 129-132 (1948) *April.*

This article contains interesting modern information on layout of compressor stations. Specific information on Magnolia's Vanderbilt plant (designed by Hudson Engineering Company) is included. Of particular interest is a cross-sectional sketch of a compressor foundation and basement showing relative location of equipment.

J. D. Parent

Drilling Fluids

Kennedy, H. T. CHEMISTRY OF DRILLING FLUIDS. *World Oil* **127**, 90, 93-94 (1948) *April.* A brief discussion of the physical chemistry of drilling fluids is presented.

J. D. Parent

Gas Injection

Squires, F. WATER-FLOODING OPPORTU-

NITIES EXPLORED BY GAS INJECTION. *World Oil* 127, 136-140 (1948) *April.*

Relative permeability of various sections of producing sand and discontinuities in the sand are studied by means of gas injection. Even direction and extension may be studied by this means which is essentially observation rate of pressure build up and subsequent decline in gas pressure at shut-in wells.

J. D. Parent

Natural Gas Compressibility

Eilerts, C. K., Carlson, H. A. and Mullens, N. B. EFFECTS OF ADDED NITROGEN ON COMPRESSIBILITY OF NATURAL GAS. *World Oil* 128, 129-132, 134, 136, 138, 140 (1948) *June.*

This is the first in a series of articles which describe the results of PVT studies on mixtures of nitrogen and natural gas. In this first article compressibility data for a natural gas are given. Data for mixtures and a rule for compressibility calculation for mixtures are to follow.

J. D. Parent

Natural Gas for Enrichment

Reed, H. W. AN "OUTSIDER" LOOKS TO NATURAL GAS. *Am. Gas Assoc. Monthly* 30, 7-8 (1948) *June.*

High cost of raw materials and increased plant construction costs place manufactured gas companies in an unfavorable competitive position with electricity. A shift in the buying public's preference in manufactured gas localities may produce similar reactions in adjacent localities serviced by natural gas with a consequent deleterious effect on the whole industry. Natural-gas enrichment of manufactured gas to produce a product which can be sold competitively is suggested as a protective measure.

J. C. Lane

Natural Gasoline Plant

Attaway, D. NEW GASOLINE PLANT FOR CARTHAGE FIELD. *Petroleum Engr.* 19, 87, 90, 94, 97 (1948) *May.*

Quite complete details of construction are given for a new gasoline plant of Arkansas Fuel Oil Company. Capacity is 100 MMcf per day and absorber pressure is 1050 psi. The gas is very moist and special precautions must be taken to avoid hydrate formation.

J. D. Parent

Transmission

Miller, B. GAS TRANSPORTATION SYSTEM CALCULATIONS. PART III—NO. XXVI. *Gas Age* 101, 31-36, 40 (1948) *May* 27.

The author describes the commonly used methods of estimating the compressibility factor for a mixture such as natural gas. The reliability of the methods is discussed briefly.

J. D. Parent

6. PETROLEUM AND SYNTHETIC LIQUID FUELS

Boiling Point–Flash Vaporization Curve Correlation

Nelson, W. L. and Harvey, R. J. A CORRELATION OF A.S.T.M., TRUE BOILING

POINT AND FLASH VAPORIZATION CURVES. *Oil Gas J.* 47, 71-72, 77-78 (1948) *June* 17.

Forty-five true boiling point and 28 ASTM distillation curves covering a range of stocks, such as crude oils, gas oils, and kerosenes, were correlated with the respective equilibrium flash vaporization curves. A graph is presented relating the 50% point of the distillation curve (ASTM or true boiling point) with the 50% point of the flash vaporization curve. Another curve relates the slopes of the distillation curves with the slopes of the flash curves. When the 50% point and the slope are known, the complete flash curve may be obtained. The average deviation of the predicted 50% point is ±8°F, and the average deviation of the predicted slope is ±0.26 slope units (°F/%). An example is given for the use of the correlation.

W. J. Merwin

Catalyst Surface Structure

Sips, R. ON THE STRUCTURE OF A CATALYST SURFACE. *J. Chem. Phys.* 16, 490-495 (1948) *May.*

Taylor and others have demonstrated the heterogeneous nature of catalyst surfaces. A method is derived for calculating the distribution of adsorption energies if the adsorption isotherms are known, if the adsorption is localized and if there are no interactions. Use of a modified Freundlich isotherm leads to a distribution function which differs only slightly from a Gaussian one.

C. H. Riesz

Fluid Catalyst Technique

Krebs, R. W. APPLICATION OF THE FLUID CATALYST TECHNIQUE TO CATALYTIC CRACKING AND HYDROCARBON SYNTHESIS. *Petroleum Refiner* 27, 115-120 (1948) *May.*

The fluid catalyst technique is discussed in some detail with particular emphasis on its application to the Fischer-Tropsch process for producing synthetic hydrocarbons from natural gas or coal.

J. C. Lane

Gas Synthesis

Alden, R. C. and Clark, A. APPRAISAL OF GAS SYNTHESIS OPERATIONS. *Petroleum Processing* 3, 425-430 (1948) *May.*

Potential oil reserves indicate the desirability of developing a substitutable method using either coal or other materials for producing liquid and gaseous fuels. Research and development of the Fischer-Tropsch process have indicated the gas synthesis process as a possible source for liquid fuels. If economically feasible, gas synthesis of oil up to several hundred thousand bbl/day can be sustained by present estimated gas reserves. Although this quantity would be a small fraction of the total demand, excessive amounts of organic chemicals such as paraffinic acids and alcohols would be produced. It is estimated that gas synthesis would require (1) an investment of $3000 to $4000 per bbl per day and (2) steel at the rate of 6 tons per bbl per day. Corresponding figures for synthetic oil from coal indicate about twice again as much capital investment required and nearly twice as much steel. Coal, in an amount equal to 28% of 1945 production, would be required for a synthetic oil production of 650,000 bbl/day. It is felt that large scale development of oil synthesis using natural gas will depend on (1) technological developments and improvements, and (2) new gas reserve discoveries. It is certain that appreciable development of synthetic oil from coal must be preceded by a substantial increase in mining capacity.

C. Von Fredersdorff

Oil-Shale Processing

Lankford, J. D. and Guthrie, B. OIL-SHALE PROCESSING. *Petroleum Technol.* 11, TP-2360 (1948) *May.*

The progress of the Bureau of Mines program on oil shale processsing at Rifle, Colorado, is reported. A crushing plant and two 40-ton retorts are now in operation. About 18 hrs is required to complete the batch operation. Yields of 90-100% are realized on shales assaying 30 gallons per ton. The shale oil obtained is quite different from crude petroleum. The shale oil has a high pour point, low A.P.I. gravity, and contains about 0.8% sulfur and 2% nitrogen. Further refining is necessary if it is to be used for purposes other than boiler fuel. A 200 barrel per day coking-cracking unit is scheduled for completion in the summer of 1948.

C. H. Riesz

Synthesis of Liquid Fuels

Storch, H. H. REVIEW OF DEVELOPMENT OF PROCESSES FOR SYNTHESIS OF LIQUID FUELS BY HYDROGENATION OF CARBON MONOXIDE. *Chem. Eng. Progress* 44, 469-479 (1948) *June.*

After a brief review of the early work (1923-1937) on the synthesis of liquid fuels from carbon monoxide and hydrogen, more recent process developments in Germany and the United States are discussed. Salient features of the various processes are given in detail and a summary table is presented. It is shown that the fluidized iron catalyst process has the lowest steel required for the converter, about 0.6 ton/-bbl-day, and the highest space-time-yield (181 bbls/1000 cu ft-day). Synol, OXO and isoparaffin syntheses are also described.

C. H. Riesz

Synthetic Fuels Progress

Fieldner, A. C. FRONTIERS OF FUEL TECHNOLOGY. *Chem. Eng. News* 26, 1700-1701 (1948) *June* 7.

The development of fuel technology, with emphasis on synthetic liquid fuels, is briefly traced from the First International Conference on Bituminous Coal in 1926 to the present. Statistics are presented for German prewar and wartime production of synthetic liquid fuels. Present American experiments are mentioned and an optimistic outlook is taken on the subject of progress in solving the synthetic fuels problem.

J. C. Lane

Synthetic Liquid Fuels

Schroeder, W. C. COMPARISON OF MAJOR PROCESSES FOR SYNTHETIC LIQUID FUELS. *Chem. Ind.* 62, 574-577, 682 (1948) *April.*

If industry and Government undertake a large-scale synthetic fuels program, they will have to decide on which of the possible processes to employ, oil-shale, coal hydrogenation, or the Fischer-Tropsch process using natural gas or coal. This article compares these three processes with respect to types of products, present state of technological development, types and location of raw materials, and investment and production costs.

J. C. Lane

Synthetic Liquid Fuels

NATURAL GAS, COAL, OIL SHALE AS SOURCES OF LIQUID FUELS. *Oil Gas J.* 46, 66, 68-70, 95-96 (1948) *April* 8.

It is stated that while as much crude oil remains

to be found as has already been found, the costs of crude oil production are increasing. This may result in synthetic crude oil becoming competitive with natural crude oil. Production of synthetic crude from either natural gas, coal, or oil shale is accomplished in two steps: synthesis gas is produced first, and then it is converted to crude oil. Schematic flow sheets of the processes are presented. In general, estimates of investment costs and operating costs for the synthetic crude oil processes are approaching the values for natural crude oil processing. The figures for crude from natural gas are the lowest of the three methods at the present time. Two commercial units using natural gas and having capacities of 7000 bbl/day are now under construction. It is estimated that either coal or oil shale could provide all of the 7 million bbl/day total oil consumption, but only 500,000 bbls/day could be produced from the available natural gas. The author estimates that the oil industry spent $10,000,000 on synthetic crude oil research last year.

W. J. Merwin

Water Gas Conversion Catalyst

Bridges, G. L., Gernes, D. C. and Thompson, H. L. DEVELOPMENT, PRODUCTION AND PERFORMANCE OF WATER GAS CONVERSION CATALYST. *Chem. Eng. Progress* 44, 363-381 (1948) *May.*

In the T.V.A. ammonia plant at Wilson Dam, Alabama, the carbon monoxide in semi-water gas is catalytically oxidized to CO_2. To provide catalyst for this operation a catalyst composition and manufacturing process were developed, and a catalyst plant was designed, constructed and operated. An iron-base catalyst was used because of high activity at moderate temperatures, mechanical strength, longevity, reasonable first cost, resistance to sulfur poisoning, and catalytic inertness to undesirable side reactions. A detailed study was made of settling rates of precipitate, washing, filtration, effect of promoters, and roasting conditions. Descriptions of catalyst manufacturing plant operation and ammonia plant performance are given. Results of laboratory comparison tests of the T.V.A. standard catalyst with two commercial catalysts are presented. Process steps include: (1) precipitation of ferrous carbonate by mixing sodium carbonate and ferrous sulfate, (2) washing the precipitate, (3) addition of magnesium oxide and filtering, (4) mixing the partially dried filter cake with potassium dichromate and aluminum hydroxide, (5) extrusion of catalyst, and, (6) roasting. The catalyst contained about 54% Fe_2O_3, 17% MgO, 6.8% $K_2Cr_2O_3$, 0.3% Al_2O_3, 0.3% Na_2O, 0.5% SO_3, 14% CO_2, and 7% H_2O.

C. L. Tsaros

7. ANALYTICAL METHODS AND TESTS

Analysis by Mass Spectrometer

Taylor, R. C., Brown, R. A., Young, W. S., and Headington, C. E. THE MASS SPECTROMETER IN ORGANIC CHEMICAL ANALYSIS. *Anal. Chem.* 20, 396-401 (1948) *May.*

The application of the mass spectrometer to the analysis of mixtures of a variety of organic and other substances is described, in order to show its utility to analyze substances other than the usual hydrocarbons. Data are given for both gases and volatile liquids, and the use of this instrument in the identification of high polymers is described. Limitations, such as the difficulty of handling water, the amines and some alcohols and the problems of resolving some of the higher hydrocarbons are indicated.

S. Katz

Analysis of Iso-Butene Binary Mixtures

Houtman, J. P. W. SIMPLE CHEMICAL ANALYSIS OF ISO-BUTENE IN BINARY MIXTURES WITH OTHER OLEFINS. *J. Inst. Petroleum (British)* **34**, 255-270 (1948) *April.*

A method is presented for the analysis of the binary mixtures of iso-butene with propene, butene-1, butene-2, iso-butane, and butadiene. The analysis is based on the reactivity of an unsaturated tertiary carbon atom of iso-butene as compared with hydrocarbons without this configuration. Aqueous hydrochloric acid at room temperature as a reagent and the Bunte method of gas analysis, isobutene is reacted and forms tert. butyl chloride. Correction is applied for the solubility of the other gases in the reagent. An accuracy of approximately 1% is obtainable.

M. C. Miyaji

Aromatics and Olefin Determination

Berg, C. and Parker, F. D. DETERMINATION OF AROMATICS AND OLEFINS IN HYDROCARBON MIXTURES. *Anal. Chem.* **20**, 456-457 (1948) *May.*

A modified acid solubility method offers improved accuracy in the determination of aromatics and olefins in hydrocarbon mixtures. The method is simple and rapid and errors due to incomplete solution of olefins and partial solution of saturates have been considerably reduced. The test is carried out by adding 15% fuming sulfuric acid to a solution of the sample in glacial acetic acid. Tests on various known mixtures have determined the optimum glacial acetic acid-fuming sulfuric acid ratio and have shown the method to be superior to the 98% sulfuric acid method.

Authors' Abstract

Aromatic Plus Olefin Determination

Mills, I. W., Jurtz, S. S., Jr., Heyn, A. H. A. and Lipkin, M. R. DETERMINATION OF TOTAL AROMATIC PLUS OLEFIN. *Anal. Chem.* **20**, 333-338 (1948) *April.*

A procedure is presented for the determination of the total olefin and aromatic content of hydrocarbon mixtures ranging from 80% added isopentane to a 90% boiling point of 600°F. The method employs a mixture of 30% by weight of phosphorous pentoxide and 70% by weight of 95% sulfuric acid. The method involves treating the sample with the sulfonating mixture at a temperature of 0° to 5°C for 20 minutes. A series of blends, each containing an aromatic and saturated hydrocarbon, was tested to determine the extent to which the sulfonating mixture would remove different aromatics. The average deviation was 0.5%. Data is presented to show effect of pre-cooling or temperature rise during shaking; and also to show that prolonged shaking had little effect on the absorption of olefins and aromatics.

R. D. Clevenger

Calorimeter

Hill, H. and Bell, R. M. A VERSATILE CALORIMETER FOR SPECIFIC HEAT DETERMINATIONS. *ASTM Bull.* **151**, 88-91 (1948) *March.*

Details of construction and operation of an adiabatic calorimeter for determining the specific heats of insulating materials are described. This calorimeter may be used to make measurements at temperatures ranging from 125°C to 1000°C. Results are presented for insulating firebrick, glass, calendered linoleum, and various other materials.

H. Hakewill

Electrostatic Separation

Fraas, F. and Ralston, O. C. DIELECTRIC CONSTANT IN AIR-AMBIENT ELECTROSTATIC SEPARATION. *U.S. Bureau Mines Report of Investigations* 4278 (1948) *April.*

A fundamental study is made of the effect of a high dielectric constant, high resistivity, barium strontium titanate particle in an air ambient electric field. The particle subjected to a D.C. field was deflected in a roller type separator. In a 60 cycle A.C. field the only possible force is due to non-homogeneity of the field. This force is very small and is only appreciable near the electrode. This is verified by an equation derived in this paper.

S. Mori

Infrared Spectrometry

Barnes, R. B., Gore, R. C., Stafford, R. W. and Williams, V. Z. QUALITATIVE ORGANIC ANALYSIS AND INFRARED SPECTROMETRY. *Anal. Chem.* **20**, 402-410 (1948) *May.*

The use of infrared spectrometry to supplement conventional qualitative organic analysis is described. A chart is presented in which characteristic absorption frequencies are correlated with functional groups. The application of the infrared approach to a series of eleven specific problems is described in detail.

S. Katz

Natural Gas Analysis

Boomer, E. H., Gillies, A. and Hugill, J. I. LOW TEMPERATURE, LOW PRESSURE FRACTIONATION OF NATURAL GAS. *Canadian J. Research Sec. B* **26**, 202-214 (1948) *February.*

An apparatus and procedure are presented for analyzing natural gas. The results are highly accurate with duplicate results agreeing within 0.05 to 0.1%. For precise analysis a small gas sample of 50 to 150 cc is sufficient, with an analysis time of approximately 25 hours. A detailed drawing of the fractionating column is shown and also a diagram of the associated apparatus is found.

M. C. Miyaji

Organic Sulfide Determination

Sease, J. W., Lee, T., Holzman, G., Swift, E. H. and Niemann, C. QUANTITATIVE METHODS FOR CERTAIN ORGANIC SULFIDES. *Anal. Chem.* **20**, 431-434 (1948) *May.*

The reactions of bromine, chloramine-T, iodate, and iodoplatinate with organic sulfides, particularly bis(2-chloroethyl) sulfide and thiodiglycol, have been critically examined in respect to their application to analytical methods for the determination of these latter substances.

Authors' abstract

Particle Size Determination

Saunders, E. NOMOGRAPH FOR PARTICLE SIZE DETERMINATION WITH THE SHARPLES SUPERCENTRIFUGE. *Anal. Chem.* **20**, 379-381 (1948) *April.*

A nomograph applicable to any system and to centrifuges of varying dimensions is presented for use in the determination of particle size and particle distribution in colloidal systems. An accuracy of 1% is demonstrated by com-

paring the mathematical solution of a given problem with that obtained from the nomograph.

H. Hakewill

Thiophene Determination

McKee, H. C., Herndon, K. and Withrow, J. R. ESTIMATION OF THIOPHENE IN GASOLINE. *Anal. Chem.* 20, 301-381 (1948) *April.*

The development of a colorimetric method for the determination of thiophene in gasoline is described. This method depends upon the reaction of thiophene with isatin to form the blue dye, indophenine. The intensity of the blue color formed is a function of the thiophene concentration and may be judged visually by comparison with known standards or measured by means of a photoelectric instrument. Gasoline samples of only 1-2 ml are required for thiophene analysis by this method. The method has been employed by the authors to analyze about 100 unknown samples ranging in concentration of thiophene sulfur from 0.002% to 1.00%. The results obtained by this method are claimed to be within 15-20% of the amount of thiophene sulfur present when a photoelectric colorimeter is employed and within 25-30% when compared visually.

H. Hakewill

Water Determination

Weaver, E. R. and Riley, R. MEASUREMENT OF WATER IN GASES BY ELECTRICAL CONDUCTION IN A FILM OF HYGROSCOPIC MATERIAL AND THE USE OF PRESSURE CHANGES IN CALIBRATION. *J. Research Natl. Bur. Standards* 40, 169-214 (1948) *March.*

The electrical conductivity of a thin film of such a material as phosphoric acid changes over a wide range with changes in the concentration of water in the atmosphere with which it is in contact. By adjusting the pressures of a sample of gas of known and one of unknown composition, they can be made to have the same concentration of water, shown by the production of equal resistances of the detecting film. Apparatus and procedures for making such adjustments and calculating analyses are given in detail, and numerous applications are described. The method has the merits of simplicity, speed, and great sensitivity. Only small samples are needed, and few substances interfere.

Authors' abstract

8. GENERAL AND PHYSICAL CHEMISTRY

Density Correlation

Othmer, D. F., Josefowitz, S. and Schmutzler, A. F. CORRELATING DENSITIES OF LIQUIDS. *Ind. Eng. Chem.* 40, 883-885 (1948) *May.*

Logarithmic plots of the densities of various compounds vs. the densities of a reference liquid at the same critical difference temperatures give straight lines. The slopes of the lines are very close to unity. Mathematical derivations indicate the theoretical basis of this plot. A nomograph is developed from which the density of any compound at any temperature can be determined if the density for that compound at two different temperatures is known.

H. L. Hsu

Equilibrium Composition of Gaseous Systems

Krieger, F. and White, W. B. A SIMPLIFIED METHOD FOR COMPUTING THE EQUILIBRIUM COMPOSITION OF GASEOUS SYSTEMS. *J. Chem. Phys.* **16**, 358-360 (1948) *April.*

A generalized procedure is proposed for computing the equilibrium composition of a gaseous system of any degree of complexity. The method, which is a somewhat simplified variation of Brinkley's method *(Gas Abstracts* **3**, 64-65 (1948) *April)* develops a system of n equations in n unknowns. An iteration method of solution is then used to solve the equations. The method lends itself to both punched card or calculator techniques.

S. Katz

Hydrogen Sulfide Properties

West, J. R. THERMODYNAMIC PROPERTIES OF HYDROGEN SULFIDE. *Chem. Eng. Progress* 44, 287-292 (1948) *April.*

The thermodynamic properties of hydrogen sulfide have been calculated and the data are presented in tabular form and on a Mollier chart. The tabulated data include the properties of saturated hydrogen sulfide between —76.4°F and 212.9°F, and of superheated hydrogen sulfide from 40°F to 1300°F at pressures of 1, 10, 20, 30, 40, 50, 60 and 70 atmospheres. The heats of formation of hydrogen sulfide in these temperature ranges are also given.

S. Katz

Oxidation of Higher Hydrocarbons

LOW TEMPERATURE OXIDATION OF HIGHER HYDROCARBONS AT ATMOSPHERIC PRESSURE. *Nature (British)* **161**, 360-361 (1948) *March* 6.

Results of ignition experiments with n-heptane and a mixture of n-heptane and benzene between 300 and 500°C at atmospheric pressure in a Moore-type apparatus are reported. Three temperature zones could be observed for each of the samples, characterized by the magnitudes of the pre-ignition and the ignition pressure pulses and the time intervals between their occurrence. From the analytical data it was concluded that initiation occurred through the formation of secondary alkyl radicals, leading to secondary alkyl hydrogen peroxide radicals and to secondary alkyl hydrogen peroxides. Decomposition of the latter into RCHO + R. + .OH seems to agree with the magnitude of the pressure pulse registered on the manometer. The chain reactions which follow the decomposition of the secondary alkyl hydrogen peroxides in the "low temperature" region still await a reasonable explanation although a combination of the schemes proposed by Lewis and VonElbe ("Combustion, Flames and Explosions", 1938) and Ubbelohde (*Proc. Roy. Soc., A*, **152**, p. 354, 1935) may present a reasonable explanation.

H. R. Linden

Permeability Studies

Arnell, J. C., and Henneberry, G. O. PERMEABILITY STUDIES. III. SURFACE AREA MEASUREMENTS OF CARBON BLACKS. *Can. J. Research Sec. A.* **26**, 29-38 (1948) *March.*

The surface area of a carbon black of diameter range 0.01 to 0.1 micron was determined by electron microscopic count and by the permeability and nitrogen adsorption techniques. All are thought to be reliable within 10%. A modified Kozeny equation is used in conjunction with permeability methods. The reliability of each method is analyzed.

J. D. Parent

Reactions of Carbon Filaments

Strickland-Constable, R. F. THE INTERACTION OF CARBON FILAMENTS AT HIGH TEMPERATURES WITH NITROUS OXIDE, CARBON DIOXIDE AND WATER VAPOUR. *Trans. Faraday Soc. (British)* 43, 769-778 (1947) *November-December.*

The reactions of N_2O, CO_2 and H_2O with carbon filaments have been studied at high temperatures at pressures below 1 mm Hg. All the reactions were found to be of the first order above 1200°C but tend to fractional orders at lower temperatures. The reaction rates, in all cases, increase slowly from 900 to 1200°, then remain constant to 1600° in the case of N_2O and 2000° in the other cases when the rate begins to increase again. Considerable dependence of the rates on the past history of the carbon was noted, especially in the middle temperature region. In the cases of N_2O and H_2O, the principal oxide formed was CO, and very little CO_2 was collected.

S. Katz

Surface Tension Correlation

Othmer, D. F., Josefowitz, S. and Schmutzler, A. F. CORRELATING SURFACE TENSIONS OF LIQUIDS. *Ind. Eng. Chem.* 40, 886-889 (1948) *May.*

Using the correlation of surface tension to temperature, $\sigma = \sigma_0 (1 - T/T_c)_n$, where σ is the surface tension and σ_0 and n are constants for each liquid, surface tensions of various compounds have been plotted to give straight lines on logarithmic paper vs. surface tensions of benzene at the same critical difference temperatures. Surface tension of any liquid at any temperature can be read off from the new nomograph when surface tension at two different temperatures is known.

H. L. Hsu

Thermodynamic Properties of Benzene

Oliver, G. D., Eaton, M., Huffman, H. M. HEAT CAPACITY, HEAT OF FUSION AND ENTROPY OF BENZENE. *J. Am. Chem. Soc.* 70, 1502-1505 (1948) *April.*

From measurements of the heat capacity of benzene in the temperature range from 12 to 341°K, and other data, the entropy of the liquid and vapor at several temperatures has been determined. Molal heat capacities and a newly determined melting point are also given.

S. Katz

Thermodynamic Values of Hydrocarbon

Bremmer, J. G. W. and Thomas, G. D. THE EXTENSION OF THERMODYNAMIC VALUES FROM THE ALIPHATIC TO THE AROMATIC SERIES. *Trans. Faraday Soc. (British)* 43, 779-785 (1947) *November-December.*

The free energies of aliphatic hydrocarbons may be expressed as an additive property of the individual groups. With modifications this rule may be extended to cover aromatic structures.

S. Katz

10. CHEMICAL ENGINEERING

Flow of Granular Masses

Brown, R. L. and Hawksley, P. G. W. THE

INTERNAL FLOW OF GRANULAR MASSES. *Fuel (British)* 26, 159-162 (1947) *November-December.*

The flow of course and fine granular masses has been studied using two-dimensional models. It is observed that local clusters of particles tend to form tightly packed groups. These groups, rather than the particles themselves apparently are, in some way, the fundamental units in the flow of granular systems.

S. Katz

Heat Transfer

Edwards, D. A., Bonilla, C. F. and Cichelli, M. T. CONDENSATION OF WATER, STYRENE, AND BUTADIENE VAPORS. *Ind. Eng. Chem.* 40, 1105-1112 (1948) *June.*

The condensation of water, styrene, and butadiene vapors, and of water-styrene and water-butadiene mixtures at or near their constant boiling compositions has been studied in a 1-inch diameter and 8-inch long vertical condenser. Wall thermocouples permitted the calculation of the film coefficients of heat transfer; 300 runs were carried out. Pressure ranged from 14 mm. absolute to atmospheric for styrene and 34 to 100 pounds per square inch absolute for butadiene. The coefficients for water averaged 6% above the Nusselt theory and for butadiene 40% above. For styrene they averaged 129% higher than theory. Assuming the vapor mixtures were at the equilibrium composition and that the condensate film consisted of the organic constituent alone, the Nusselt theory was found to correlate the results with two immiscible components more consistently than other available relations; deviations were in the direction of obtaining conservative design. Coefficients for the system styrene-water averaged 43% higher and for butadiene-water 34% higher than theory. Film Reynolds numbers ranged from 9 to 1460.

Authors' abstract

Heat Transfer

Rushton, J. H., Lichtmann, R. S. and Mahony, L. H. HEAT TRANSFER TO VERTICAL TUBES IN A MIXING VESSEL. *Ind. Eng. Chem.* 40, 1082-1087 (1948) *June.*

Data are presented for heat transfer coefficients from vertical tubes acting as baffles in addition to heat exchange surface in a vertical cylindrical tank equipped with standard design flat blade mixing turbines. Data also show proper positioning of impeller for optimum heat transfer rates. The experimental unit consists of a tank 4 feet in diameter, a dynamometer drive for the agitator, and vertical heating and cooling coils.

Authors' abstract

Heat Transfer Rates

Huebler, J. RADIATIVE AND CONVECTIVE HEAT TRANSFER RATES PERTAINING TO HEATING PROCESSES. *Ind. Eng. Chem.* 40, 1094-1098 (1948) *June.*

In recent years there has been a great focus of attention upon rapid heating methods employing radiation, convection, and induction. Concrete analyses of the effective value of convection versus radiation are difficult to perform because of the inseparable character of the two phenomena. The present paper seeks to compare, under theoretically ideal conditions, the effect of radiation and convection heating simultaneously applied to a plate. For this purpose an equivalent radiation "heat transfer coefficient" is utilized, and although the differential equations involved are insoluble, graphical methods of solution are applied. The results reveal the contribution made by convection alone to the total heat transfer attainable under assumed conditions and its ratio to heat transfer by radiation.

Author's abstract

Oxygen Production

Schuftan, P. M. MODERN GASEOUS OXYGEN PRODUCTION METHODS. *Gas Times (British)* 54, 274, 276-278, 280-281 (1948) *February* 27.

The development of (1) regenerators and reversing heat exchangers as efficient means for transferring heat, (2) highly efficient machines for cold production (such as the impulse turbine), and (3) efficient rectification columns, has led to a thermodynamic efficiency of medium purity oxygen plants of 19% as compared to 13% achieved by "classical" plants. Modern practice (1) requires a low pressure drop in the heat exchangers, (2) utilizes turbines instead of reciprocating engines except where air is used at a high pressure, and (3) achieves direct cleaning of the intake air by deposition of solid CO_2 and water vapor in the heat exchangers. Improvements in the efficiency of rectification should be possible through the development of more efficient rectification trays together with the adoption of the Lachman principle of introducing nearly atmospheric pressure air into the upper section of the column, thereby decreasing the required reflux ratio. Included in the description of modern oxygen producing plants are Kellogg, Collins, Linde Air Products, Rescol, and Linde-Frankl processes.

C. Von Fredersdorff

11. PROCESS EQUIPMENT AND INSTRUMENTATION

Agitator Selection

Bissell, E. S. THE ECONOMICS OF AGITATOR SELECTION. *Chem. Ind.* 62, 586-588 (1948) *April.*

The various factors affecting an economic agitator selection, such as materials of construction, relative costs, multiple and single installations, and cost of operation versus power requirements, were discussed. The advantages, disadvantages, and applications of mechanical seals, integral and separate stuffing boxes were reviewed. Mention was made of the close cooperation necessary between vendors and users in order to obtain optimum selections.

B. E. Hunt

Automatic Temperature Control

Adams, A. M. AUTOMATIC TEMPERATURE CONTROL. *Brit. Coal Utilization Research Assoc. Monthly* 12, 73-87 (1948) *March.*

A general review is presented of the principles of automatic temperature control. The methods of automatic control which are discussed are: on-off; proportional; time-proportional; proportional-reset; and derivative. The requirements for satisfactory operation and the characteristics of each of the above methods of control are tabulated. A review is given of the various types of measuring elements, such as those using dimensional changes, electrical or magnetic principles, and optical effects. The mediums of control mentioned are mechanical, pneumatic, hydraulic, electrical, or electronic. A bibliography of 107 references is given and a more complete discussion of the theories of control is presented in the appendix.

W. J. Merwin

Boiler Maintenance

Tomkins, S. S. BOILER WATER CONDITIONING AND CHEMICAL CLEANING OF

BOILER. Paper presented at American Gas Association Joint Production and Chemical Committee Conference, Asbury Park, New Jersey, May 24-26, 1948.

A short introduction was presented in which were discussed the various undesirable constituents of boiler feed water, the harmful effects caused by these constituents, and various methods, both external and internal, of eliminating or counteracting their effects. The various factors causing embrittlement of the boiler, a method of detecting embrittling conditions and some remedies for the situation were discussed. The internal cleaning of the boiler was emphasized by a detailed description of the method of solvent cleaning. Several charts and photographs were included to illustrate various points brought out in the paper.

B. E. Hunt

12. MATERIALS OF CONSTRUCTION

Cathodic Protection

Ewing, S. P. and Bayhi, J. F. CATHODIC PROTECTION OF CASINGS IN LOUDON POOL. *Corrosion* 4, 264-286 (1948) *June.*

Two electrical methods, the IR drop and the current potential method, used in determining the required current necessary to cathodically protect a well casing are discussed in detail with graphs. The value of the data collected is also carefully studied. By the IR drop method the minimum distance between the sacrificial anode and the well casing can also be determined, as well as the anodic condition of the open circuit well casing.

S. Mori

Corrosion in Meters

Jones, S. and Speers, J. A. INVESTIGATION ON CORROSIVE MATTER IN METERS. *Gas Times (British)* 55, 243 (1948) *May* 21.

See *Gas Abstracts* 4, 105 (1948) *May* for abstract.

Corrosion Resistant Alloys

Eilerts, C. K., Green, F. and Archer, F. G. ALLOYING STEELS FOR CORROSION RESISTANCE TO GAS-CONDENSATE FLUIDS—PART I. *Corrosion* 4, 245-263 (1948) *June.*

Relative merits of different alloys for resisting corrosion in a high pressure gas condensate well were compared by laboratory tests using a commercial hot rolled steel designated SAE 1005 as a standard for comparison. Results indicated that 9% chromium steel was most suitable as to corrosion resistance, physical strength, and cost. Copper nickel alloys showed only a small loss in weight due to corrosion, but this was not a true indication of its durability, since it formed localized pitting type of corrosion. Added to this, the alloy is also quite expensive.

S. Mori

Insulating Materials

INSULATING MATERIALS AND METHODS FOR USE AT LOW TEMPERATURES. *Nature (British)* 161, 323-325 (1948) *February.*

Some data are presented for thermal conductivity measurements on insulating materials for use at low temperatures. For very low temperature measurements a cold face temperature of —181°C and a mean temperature of about —84°C were utilized. Other results were obtained with mean temperatures varying between —27°C and +16°C. In discussing the impracticability of vacuum insulation, a state-

ment is made that a 57 ton vacuum-insulated oxygen storage tank had an evaporation loss of 0.16% of its contents per 24 hrs. A similar vessel insulated with rock wool had an evaporation loss on the same basis of 0.2%.

W. K. Zahray

Pipe Line Corrosion

Parker, M. E. THE WHY, HOW, AND WHAT ON PIPE LINE CORROSION. *World Oil* **127**, 184, 186, 188, 190 (1948) *April.*

A metal higher than hydrogen in the electromotive force series, such as iron, would tend to corrode in presence of a water solution if there is a variation in the conditions at different locations on the metal surface. This is inevitable in pipelines, and this may be combatted most economically by using both waterproofed pipe coating, and a cathodic protection simultaneously. The former alone is limited by the impossibility of getting a perfect non-leakage coating, and the latter alone by excess cost of generating electricity, but the two together may bring about a greater protection at a lower cost.

S. Mori

Refractories

Hilliard, A. and McKee, J. H. THE DEVELOPMENT OF REFRACTORIES FOR HIGH TEMPERATURE INDUSTRIAL PROCESSES. *Brit. Coal Utilization Research Assoc. Monthly* **11**, 457-468 (1947) *November.*

The successful production of ever increasing quantities of iron and steel and allied products since the Industrial Revolution is attributed largely to the improvement of refractories. Future progress in furnace technique will depend on the development of higher-temperature resistant materials. Among the factors controlling the refractory properties are the nature, particle shape, size, and size distribution of the powder used. It is common practice to add a prefired coarse material to the raw powder and to incorporate either a temporary or permanent binder before casting and firing. Factors to be considered in the evaluation of applicability of a refractory are the crystalline structure, allotropic forms and other chemical changes, such as dissociation and inversion, which may occur at various temperatures. For example, the silica in silica firebrick exists as (1) d-quartz at room temperature, (2) B_2—tridymite at 870°C, and (3) B-cristobalite at 1470°C. The changes in specific volume which occur with these phase changes of silica cause silica brick to be abnormally sensitive to thermal shock. Any material exhibiting such phase changes requires an extremely slow heating-up period and should preferably be kept at operating temperature continuously. Phase equilibria data are often useful for predicting the behavior of the refractory as a function of temperature. Although difficult to classify, refractories may be referred to as acid (high proportion of silica such as fireclay and aluminous firebrick), neutral (such as carbon refractories, sillimanite and chromite) and basic (alumina, magnesite and dolomite refractories). Among the high-melting point refractories are carbides, borides and nitrides of titanium, zirconium, tantalum, and tungsten. A primary consideration in the use of high temperature materials is a high resistance to slag attack, an example of which are zircon compounds. Other groupings include low temperature insulating (high porosity such as asbestos, diatomite and vermiculite) and hot face (magnesia, chrome-magnesite and zirconia) refractories.

C. Von Fredersdorff

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